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ABSTRACT

This paper describes the current policies and initiatives regarding the application of technology in Canada, Mexico and the United States. It also analyzes the need for policy development regarding technological networks, equipment, and educational content. The report also includes recommendations regarding specific initiatives for tri-national collaboration in the use of technology to improve higher education. The contents include descriptions of the policies and initiatives at the federal, regional, and state (provincial) levels in Mexico, Canada, and the United States. Institutional policies and initiatives are also examined as are collaborations between business and higher education. The paper concludes with a summary of current policy climate in the three countries and suggests opportunities for cross-border collaboration. These include development of tri-national policies regarding accreditation of distance education courses and portability of students' knowledge and skills acquired among institutions and across borders; trinational staff and faculty training in the use of technology; trinational discipline--specific forums for faculty with similar interest; implementation of pilot projects; creation of a mechanism for international and inter-institutional sharing of information and experience; and creation of consortia and partnership models. (JLS)

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ED 410 829

Understanding the Differences

A Working Paper Series on
Higher Education in Canada,
Mexico, and the United States

Working Paper #5

The Role of Technology in Higher Education in North America: Policy Implications

by
Glen Farrell,
Sally Johnstone,
and
Patricio López del Puerto

IHE 030 403

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WICHE's broad objectives are to:

- Strengthen educational opportunities for students through expanded access to programs,
- Assist policymakers in dealing with higher education and human resource issues through research and analysis,
- Foster cooperative planning, especially that which targets the sharing of resources.

In 1993, WICHE, working in partnership with the Mexican Association for International Education (AMPEI), developed the U.S.-Mexico Educational Interchange Project to facilitate educational interchange and the sharing of resources across the western region of the U.S. and with Mexico. In 1995, the project began a trinational focus which includes Canada, with the goal of fostering educational collaboration across North America. This series, "Understanding the Differences," was developed as a resource for the project and was created under the direction of WICHE's Constituent Relations and Communications and its Information and Policy Unit.

Funding for the working paper series was provided by The Ford Foundation. Publications in the series include:

- Working Paper #1: *Policy Approaches to Evaluation and Incentive Funding in U.S. and Mexican Higher Education* (Publication Number 2A261)
- Working Paper #2: *Higher Education Faculty in Mexico and the United States: Characteristics and Policy Issues* (Publication Number 2A262)
- Working Paper #3: *The Educational Systems of Mexico and the United States: Prospects for Reform and Collaboration* (Publication Number 2A263)
- Working Paper #4: *Higher Education's Responsiveness in Mexico and the United States to a New Economy and the Impacts of NAFTA* (Publication Number 2A264)
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Working Paper #5:

The Role of Technology in Higher Education in North America: Policy Implications

by Glen Farrell, Sally Johnstone, and Patricio López del Puerto

"Understanding the Differences"

A Working Paper Series on Higher Education in Canada, Mexico, and the United States

Western Interstate Commission for Higher Education
P.O. Box 9752
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Preface

A major obstacle to higher education collaboration in North America is that educational policymakers and practitioners lack familiarity with the structures and issues of each other's educational systems. There are often assumptions on all sides that the three systems function similarly. To date, only limited information exists on educational policy issues affecting the Canada, Mexico and the United States, particularly in a comparative context.

Beginning in 1994, in an effort to fill that void, and with the encouragement of The Ford Foundation's Representative for the Office for Mexico and Central America, Norman Collins, and the The Ford Foundation's Vice President of Education, Arts and Culture, Alison Bernstein, WICHE began developing a series of reports, entitled *Understanding the Differences*. The series analyzes the major policy issues and differences in each country, so that meaningful discussions among higher education leaders and policymakers may occur toward the goal of developing new binational and trinational initiatives. The initial working papers (1-4) and the comparative essay were binational comparisons of the Mexican and U.S. higher education systems. In 1995, the project began a trinational focus which includes Canada, with the goal of fostering educational collaboration across North America. This fifth working paper, *The Role of Technology in Higher Education in North America: Policy Implications*, is the series' first trinational comparison.

Understanding the Differences is one of the key components of the U.S.-Mexico Educational Interchange Project, an initiative developed to remove the obstacles to North American educational interchange and increase understanding and opportunities for collaboration in Mexico, Canada, and the western United States. The Western Interstate Commission for Higher Education has combined its efforts with the Asociación Mexicana para la Educación Internacional, the University of Arizona, the Universidad Autónoma de Baja California, and the University of British Columbia to achieve these objectives. WICHE's *Understanding the Differences* series includes:

- Working Paper #1: *Policy Approaches to Evaluation and Incentive Funding in U.S. and Mexican Higher Education*, by Peter Ewell and Rollin Kent. This paper explores the growing desire shared by the two nations to obtain a significant "return on investment" in postsecondary education. The authors establish a context for comparison within Mexico and the United States and discuss the challenges and central policy dilemmas that each country faces as it attempts to implement the policy tools of evaluation and incentive funding. Past experiences and future directions for accountability and categorical funding mechanisms are explored.
- Working Paper #2: *Higher Education Faculty in Mexico and the United States: Characteristics and Policy Issues*, by Cheryl Lovell and Dolores Sánchez Soler. This paper describes and compares Mexican and U.S. faculty characteristics and conditions, including total number of faculty, student-teacher ratios, full- versus part-time status, rank, tenure, average salaries, gender and ethnicity, and union membership. Several contemporary policy issues are explored including faculty evaluation, workload and productivity, curriculum reform, faculty involvement with the business community, faculty development, and implications that NAFTA will have for faculty on both sides of

the border. The paper concludes with some suggested areas for collaborative efforts of faculty in the two countries.

- Working Paper #3: *The Educational Systems of Mexico and the United States: Prospects for Reform and Collaboration*, by JoAnn Canales, Leticia Calzada Gómez and Néllyda Villanueva. This paper describes the sequential processes of education (from basic to higher education) in Mexico and the U.S. as a basis for understanding the relationships between the various levels of education. It analyzes the fragmented nature of the educational systems common to both countries and outlines possible solutions for integrating the different systems. Also included are brief overviews and examples of national, state and local collaborative relationships. The paper concludes with a discussion of ways to nurture and enhance binational collaborative relationships.
- Working Paper #4: *Higher Education's Responsiveness in Mexico and the United States to a New Economy and the Impacts of NAFTA*, by Elizabeth Santillanez. This paper discusses the critical role that higher education must play as the U.S., Mexican and Canadian markets become more integrated since the implementation of NAFTA. The paper gives an overview of recent transformation of economic developments and business needs which require that higher education better prepare students to compete in the global workforce. It describes initiatives currently underway and gives recommendations for higher education policymakers to consider as they develop a workforce which is competitive and culturally-aware.
- The main comparative report: *Understanding the Differences: An Essay on Higher Education in Mexico and the United States*, by Judith I. Gill and Lilian Alvarez de Testa. The goal of this comparative report on higher education in Mexico and the United States is to provide an understanding of the major issues and differences in each country so that meaningful discussions may occur towards the development of new binational programs. While fully acknowledging the distinct contexts particular to each country, the report analyzes shared factors which contribute to the need for reform and change, including a perceived decline in educational quality; increasing enrollment demands; increased social, economic and cultural diversity within the workforce; rapid advances in technology; and increased and global economic competition.

WICHE thanks Alison Bernstein, Janice Petrovich, and Norm Collins of The Ford Foundation, and Clint Smith of the William and Flora Hewlett Foundation for their generous support of the general WICHE/AMPEI U.S.-Mexico Educational Interchange Project, and for their recognition of the importance of policy studies in North American higher education.

WICHE acknowledges the trinational team of authors of this working paper who freely gave of their time to share their expertise with others: Glen Farrell, president of the Open Learning Agency, British Columbia Open University, Canada; Sally Johnstone, director of WICHE's Western Cooperative for Educational Telecommunications; and, Patricio López del Puerto, dean of Sciences and Humanities at the Instituto Tecnológico y de Estudios Superiores de Monterrey in Mexico. The authors eagerly worked through language barriers, cultural differences and logistical obstacles, in the spirit of true cross-border cooperation and exchange, which should characterize a project of this nature. We hope their cooperative efforts will inspire other researchers to pursue future binational and trinational collaborations.

Paula Palmer provided valuable editorial assistance in reformulating the three different perspectives into one, coherent and comparative piece. Thanks also to WICHE staff members Debby Jang (graphics support) and Mary Ellen Keller (production). WICHE acknowledges Jere Mock, Jaime Gutierrez, and Francisco Marmolejo for managing the project and their editorial assistance; and Margo Schultz for her editorial assistance, coordination of the communications with the authors, editor, and translators, as well as the layout of the final manuscripts.

WICHE hopes that this series will foster improved understanding of significant higher education issues in Canada, Mexico, and the United States, and, over time, lead to new cooperative efforts to increase education opportunities across North America

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October 1996

I. Introduction

In all three countries of North America, technology is a visible manifestation and a driving force behind changes in higher education. Technology is changing the way education is delivered, accelerating the shift in education from a provider and product orientation to a service and user orientation.

In this paper, policy analysts in Canada, the United States and Mexico describe the current policies and initiatives regarding the application of technology in each country's higher education system (Section II, A-E), and analyze the need for policy development regarding technological networks, appliances and educational content (Section II-F). Finally, we suggest specific initiatives that can build a foundation for trinational collaboration in the use of technology to improve higher education (Section III).

Post-secondary education structures and policies differ among all three countries, but the greatest differences are between Mexico, on the one hand, and Canada and the United States on the other. Each country is set apart by its distinct historical development, language, culture, economy, and political system. While in all three countries higher education is challenged by intensifying competition for scarce economic resources, the situation in Mexico is far more severe than in its northern neighbors.

Since 1982, Mexico has gone through a series of financial, social, political, and monetary crises that have undermined the ability of individuals and institutions to make decisions and plan for the future. The peso has devalued more than 29,350 percent since 1982. The Gross Domestic Product has bounced from positive to negative several times, suffering the worse decrease in 1995, when it dropped an astonishing 10 percent. Economic growth certainly has not been sufficient to balance population growth; today there are almost twice as many Mexicans as in 1970, generating increasing demand for jobs, health care, and other basic elements for development, including education.

Mexico is currently undergoing a metamorphosis toward a more open, market-oriented economy and a more democratic political system. Higher education institutions are involved in driving these changes, and they themselves are also changing. As with other Mexican institutions, there have been two evolutionary trends for higher education: one for the public education system, another for private universities. Resource allocation, management and institutional priorities are different for these two entities. For example, public universities are supported by federal and state allocations, keeping tuition costs

as low as $50/year, while students at private universities pay between $1,500 and $2,500/year. Governance, admissions policy, and even specialization in fields and levels, are different among public and private institutions.

While in Mexico the federal government is responsible for higher education, in the United States and Canada the primary responsibility is carried by state and provincial governments. In the U.S., the federal Department of Education coordinates the disbursement of financial support for students, collects data on higher education trends, implements a few standards and initiatives, and funds some innovative programs and research. Several federal agencies fund research and projects at higher education institutions. In Canada there is no office of education at the national level, but the federal government provides indirect support through fiscal transfers to the provinces and by funding university research and student assistance. In both countries, tuition and/or fees charged to students are increasing as federal funds decline; other sources of support for higher education include contracts with business and industry, donations, and investment income. Some colleges in the U.S. also receive local community support.

As the U.S. federal government cuts back on funding for social welfare services and Medicare, the states face an increasing financial burden to pick up these costs. States accomplish this by reducing the proportion of their support for higher education. To complicate this picture, many of the western states are also facing radical increases in demand for higher education services by both traditional students and lifelong learners. These states are looking to technology to assist in meeting this demand without having to build new campuses.

In Canada, the federal government has begun a process of significantly reducing the amount of funding provided to post-secondary education through fiscal transfers to the provinces. In response, some provinces are choosing to make reductions in other parts of government operations and not pass on the costs of the federal transfer payment cuts to students; other provinces have increased costs to the consumer.

In all three countries, policies regarding the use of technology are being developed in challenging fiscal climates. The expectation that the use of technology will expand the reach of education while holding down costs is a significant motive for the keen interest in technological applications at all levels of government and within the institutions themselves. Other developments in higher education that influence the discourse about technology include the changing nature of consumer demographics, increased demand for higher education and demand for improved quality of education.

II. Policies and Initiatives in Canada, Mexico and the United States

This section describes policies and initiatives concerning the use of technology in higher education at the federal, regional, state/province, and institutional levels in each of the three countries. Examples of collaboration between business and higher education institutions are given, and the current policy climate is summarized.

A. Policies and Initiatives at the Federal Level

In all three countries, federal policies have major impacts on the application of emerging technologies in higher education. In addition to the initiatives described below, copyright laws are undergoing revision in each country; these will have a major impact on the accessibility of telecommunicated instructional materials for higher education both within countries and among them.

Canada

In addition to its involvement in the funding of higher education, there are two more specific ways in which the Canadian government is involved in policies and initiatives that affect the use of technology in higher education.

The first, and most long-standing, results from the fact that the federal government has responsibility for telecommunications policy and regulation through the Canadian Radio and Television Commission. This Commission regulates the rates that telephone companies, cable companies and other network providers can charge and the degree to which various network providers can compete with one another. The federal regulator also plays an influencing role in that it grants cable and broadcast licenses and, in doing so, pays particular attention to the amount of Canadian content that is carried by the licensee.

The most recently developed role the federal government is playing in the use of technology is through its policy decision to facilitate and foster close collaboration among governments, educational institutions, employers and other shareholders with respect to the use of learning technologies in a context of lifelong learning.

Specifically, the Ministry of Human Resources Development has created an Office of Learning Technologies (OLT) with a mandate to expand innovative learning opportunities for Canadians using the new learning technologies. Because the federal government does not play a direct role in the provision of

higher education in the country, its actions through the OLT are focused on the development and support for demonstration and pilot projects in learning technologies at locations across the country, the development of information databases, Web sites, and Internet applications (Industry Canada, 1996).

A specific example of such an initiative is SchoolNet, a project jointly sponsored by the federal and provincial governments and the private sector to provide Canadian students and teachers with electronic services that will develop and stimulate the skills needed in the knowledge society. Currently, one-third of all schools in Canada are connected to this network; by June 1997 all schools will be connected. While this project is focused on schools, it is illustrative of what is likely to occur in the higher education sector as well.

Mexico

During the last years there have been several initiatives and constitutional reforms in Mexico which can directly impact the use of technology in higher education.

Deregulation of telecommunications has created new opportunities to facilitate the growth of the Mexican infrastructure for communications. Under the Federal Law of Telecommunications, the public, social, and private sectors can all participate in the improvement and expansion of telecommunications infrastructure. There is no restriction on the kinds of information (voice, data, or images) that can be transmitted through public telecommunications networks, whose development is open to private investment (Programa de Desarrollo del Sector Comunicaciones y Transportes 1995-2000 (PDSCT), 134 - 136). The modernization of the telephone networks and the arrival of such new corporations as Sprint, MCI, and AT&T will greatly improve the options and availability of networks and bandwidth. An open market in telecommunications is reducing costs and improving the quality of services. Higher education institutions can take full advantage of existing and new infrastructure to foster the appropriate use of technology, improve access and interactivity, and diversify media.

The Mexican government intends to create the necessary conditions to promote the use of technology at all levels of education. The Development Program for Communications and Transportation for 1995-2000 establishes as one of its objectives "to have a well-developed information infrastructure which facilitates a faster and more direct communication for the benefit of education, culture, public work, production, and entertainment" (PDSCT, 135).

The National Plan for Educational Development 1995-2000 also devotes several sections to the use of technology in education. In the specific case of higher education, it states that "development of open and distance education will be strengthened using the available infrastructure in an optimal way, creating educational opportunities in places where there are not enough institutions in any particular educational level, and for those who cannot enter the scholastic system" (Plan Nacional de Desarrollo Educativo 1995-2000 (PNDE), 148). It further states that "the installed capacity in telecommunications, computing, and audiovisual production will be used to create and transmit instructional material, integrating interdisciplinary teams" (PNDE, 151).

The General Law of Education, Article 33, directs education authorities to create distance education systems which facilitate full exercise of the right to education, foster a higher equity in education, and give equal opportunities of access.

One of the initiatives of the federal government to incorporate the use of technology in higher education started with the creation of FOMES, a fund created for the improvement higher education. Although FOMES was not originally designed to support initiatives in computing and telecommunications, the increasing demand for funds to support such initiatives inspired the Director General for Higher Education of the Secretaría de Educación Pública to propose the creation of a trust fund, administered by UNAM, to provide all state universities in the country with the infrastructure needed to connect to and use the Internet for educational purposes. The funds have been used to purchase routers and servers, contract with telecommunications services, and install computers for academic use, as well as to train those responsible for installing, maintaining and promoting the use of the Internet for educational purposes. The SEP-UNAM trust fund has allocated more than 10 million dollars to public universities in Mexico.

At the level of secondary education, Telesecundaria was established more than 30 years ago to give access to secondary education in marginal communities. Classes are broadcast and received in homes and remote classrooms.

The public education sector has also developed a media infrastructure called Edusat. It transmits video, sound, and data via satellite, with six TV and 21 audio channels. Its signal is received by 10,000 satellite dishes in schools around Mexico (PNDE, 87).

United States

The 1996 Telecommunications Act replaced a law dating back to the 1930's and has several implications for both public and private higher education. These include a potentially lower rate for high bandwidth services for primary and secondary schools and hospitals. Higher education institutions with teaching hospitals may qualify as may those working in networks that include schools. This law also says that all Americans should have access to telecommunications at reasonable rates. This may provoke the development of a new definition of "access" and could make it easier for institutions to reach potential students who do not now have adequate telecommunications connections in their area for using computer modems (Salomon, 1996).

The U.S. Department of Education has responsibility for defining what types of institutions and what types of students qualify for federal financial aid. At this point, the student must be studying at least half-time at a single institution. Students who are using technology to work with several institutions simultaneously are often ineligible for federal financial aid programs, except in cases where their institutions hold consortium agreements which would allow them to qualify.

In the mid-1980's, the federal government initiated a program to increase the use of telecommunications technology to serve primary and secondary school programs in collaboration with higher education. This Star Schools project involved many higher education institutions and served as seed funding for some to develop their telecommunications infrastructure.

The U.S. Department of Commerce sponsors two grant programs: Telecommunications and Information Infrastructure Assistance Program (TIIAP) and the National Telecommunication and Information Administration's (NTIA) infrastructure development program. NTIA's grants have been used for the last 20 years by public television stations as well as higher education institutions to finance the hardware and engineering costs for network development. TIIAP, a much newer program, funds projects designed to promote collaboration among segments of education, state governments, and the private sector in the development of applications to serve the public. Many higher education institutions have benefited from both of these programs.

The National Science Foundation's (NSF) Networking Infrastructure for Education offers grants to projects that serve students electronically. Many higher education institutions have taken advantage of this program to increase their capabilities to offer telecommunicated learning and to form partnerships with primary and secondary schools. In addition, other federal agencies have

assisted in helping higher education institutions develop networks with specific constituencies (e.g., the Department of Agriculture).

B. Policies and Initiatives at the Regional Level

Regional initiatives are found in all three countries.

Canada

For more than a decade a general agreement for cooperation in developing distance education has existed among Canada's four western provinces; in practice, little has resulted. However, in 1992, a number of universities in the provinces of Manitoba, Alberta and British Columbia formed a consortium with the educational broadcasters to develop, share and broadcast university-level telecourses. The Western University Telecourse Consortium now makes a transfer program of first- and second-year courses available across western Canada via television.

Mexico

Particularly during the last five years, higher education in Mexico has begun to abandon its traditional pattern of isolated individual institutions, characterized by limited cooperation between public and private universities, as well as limited articulation among institutions at various levels.

Today, due to diminishing resources and stimulated by a more open policy from the federal government associated with incentive funding, institutions are creating more partnerships. These partnerships are dissolving those long-held stereotypes. The Mexican Association of Universities and Higher Education Institutions (ANUIES) and the Mexican Federation of Private Institutions of Higher Education (FIMPES) have been instrumental in fostering this new collaborative paradigm.

Examples of emerging partnerships at the regional level include the newly-created Northwestern Network of Distance Education; and, the U.S.-Mexico Academic Cooperation Network (signed in San Luis Potosi, 1996 and convened by the American Council on Education, ANUIES, and the U.S.-Mexico Educational Interchange Project). All types and levels of institutions are represented in these two initiatives.

United States

Over the past 40 years, several groups of states have joined together to form interstate compacts (WICHE, SREB, NEBE, MHEC)[1] to share higher education resources and information.

Regional accreditation associations, which are independent of the interstate compacts, examine educational institutions periodically to ensure that they comply with quality control and consumer protection standards. These standards are developed independently within each region, and the regional associations operate autonomously. This system has worked well for the last century, but as institutions begin to deliver programs electronically to students outside their region, questions arise as to which association's criteria apply. This problem is compounded by state licensure of institutions (see Section II-C).

To allow institutions to function more easily in a multi-state environment, the Principles of Good Practice were developed by the Western Cooperative for Educational Telecommunications; they have been adopted by several of the regional accrediting associations and states (see *http://www.wiche.edu*). They are also being used by American and some Canadian institutions to guide the development of electronically delivered programs.

To reduce the cost of installing new technologies, two regions of the U.S. have formed multi-state purchasing cooperatives. The Mid-West Higher Education Commission (MHEC), operating since 1991, has helped arrange group purchases at lower cost for long distance telephone services specialized video equipment for compatible two-way links among institutions. In 1994 the Western Interstate Commission for Higher Education (WICHE) launched its Joint Purchasing Initiative and enabled institutions and states to save on purchases of codex and routers.

During 1996, the governors of 13 western states formed the Western Governors University (WGU), a virtual institution designed to increase access to high quality programs to meet the learning needs of lifelong learners. The WGU will be entirely electronic and will allow students to earn a degree by studying with multiple institutions without expecting one institution to accept credits from all the others. It also allows the institutions to collaborate on expensive course development and to respond quickly to changing needs of employers in the western states. The most unique feature of the WGU will be its degrees based on competencies rather than accumulated credits.

[1] Western Interstate Commission for Higher Education (WICHE); Southern Regional Education Board (SREB); New England Board of Higher Education (NEBHE); Midwestern Higher Education Commission (MHEC).

The Southern Regional Education Board (SREB) is currently exploring the formation of an electronic common market among several of the southern states.

C. Policies and Initiatives at the Provincial (State) Level

Canada

All Canadian provinces face a set of similar challenges: funds that can be provided to higher education are increasingly restricted; students needing to be served by higher education systems are becoming more diverse in an environment where lifelong learning is both an economic and a social necessity; and the training needed to maintain and develop the required work force competencies is more comprehensive and far more dynamic than ever before. Provincial governments are all, in various ways, examining how technology might help deal with these challenges. For example, four provinces (British Columbia, Alberta, Ontario, and Quebec) have long-established provincial educational television networks. The primary role of these networks in higher education has been to provide telecourses which viewers watch or record; interactivity is supplied through audio conferencing or, more recently, computer conferencing.

Some provinces, notably New Brunswick and British Columbia, are developing interactive educational networks. The concept is that all schools, colleges, universities, and public libraries (in the case of British Columbia) will have access to a dedicated digital network with bandwidth that may range from T1 to T3 capacity depending on demand. In other cases, institutions simply agree to work together to share specified resources, using existing telephone lines with conventional modem access. Typically, these arrangements arise when there is a policy vacuum at the provincial level and institutions take collective action to respond to needs that they have in common.

Mexico

Although most state governments have radio and television stations, there have not been specific initiatives to use these resources for higher education. With the recently initiated decentralization of the Mexican educational system, the participation of state governments in education will increase; more policies and initiatives at the state level can be expected.

Historically, and generally speaking, state governments in Mexico do not have direct and official involvement in the higher education system because

higher education is considered a federal responsibility and public universities are autonomous.

New models are emerging which complement the traditional higher education sector. These new models represent an increased involvement from the state governments and the business sector. The new national system of technological universities (i.e. the Center of Sciences in Sinaloa) is one example.

United States

Each state has jurisdiction over the public and private higher education institutions that serve its citizens, but this jurisdiction is exercised differently in each state. Some require licensure of each institution physically present in the state and usually rely heavily on regional accreditation. Other states have few rules covering accredited institutions operating in their state, but have licensure requirements for institutions delivering electronic programs in their state. These can be expensive for an institution to complete, especially considering that each state's requirements for reporting are unique.

In addition to jurisdiction over education, states also set policies concerning telecommunications service rates. This means that states can regulate rates charged higher education institutions within the parameters allowed by federal policies. A few states have found ways to discount high bandwidth services to the higher education institutions within their states, although this is not a common practice.

Many of the U.S. states have major initiatives to encourage higher education use of telecommunications technologies. In most states, public higher education institutions are linked with high-speed data lines. Several states also have video links among many of their higher education institutions, using either leased or dedicated systems. In some states video links are even being created among higher education institutions and high schools. For the last five years, Maine has operated an entirely electronic community college system, offering two-year associate degrees; Colorado is currently developing one. Several states, including Arizona, Maryland, Oregon, Virginia, and Washington have university-to-community college links so that students can earn baccalaureate degrees while staying in their home communities. These projects use a variety of technologies to accomplish their goals.

D. Policies and Initiatives at the Institutional Level

Higher education institutions in all three countries have taken the lead in planning and implementing the use of technology for higher education. Development, however, has been highly unequal among institutions. Assimilation of new technologies by faculty also varies widely; students generally have few problems learning to make use of the new technologies.

Canada

Canadian institutions are having to find ways of being more efficient; some are particularly proactive in embracing technology as a means of increasing the productivity of their faculty and staff and enabling some programs to become financially self-sustaining. These are the prevalent models:

1. Interactive Video Conferencing

This technology is becoming almost synonymous with the term "distance education" and with the use of technology in institutions. Typically, it involves a point to multi-point distribution network and serves as a vehicle to extend the conventional classroom and the pedagogical style that goes on within it. From the standpoint of institutional policy, it is the least disruptive use of technology since issues such as class size, work load of faculty and preparation are minimally affected. On the other hand, as a real-time application, this technology provides little improvement in terms of staff productivity or increased flexibility from the standpoint of the student. There is no evidence that it decreases the cost of providing instruction.

However, two universities are using this technology to deliver an MBA program on a complete cost-recovery basis to sites in major cities across the country. In this application the technology is certainly cost-effective in serving a market with a high demand and high tolerance for fee levels which enable full cost recovery.

2. Use of Intra-Net

Several large institutions have created an internal capacity whereby faculty may put course materials on a Web-site so that students can access them from work stations within the institution, send assignments back and forth, and participate in tutorials.

3. On-line Access Networks

Either through the use of modems and specific conferencing software such as "First Class" or, increasingly, through Internet access, asynchronous interactive tutoring, joint project work among students, file transfer for assignments and similar applications are seen on campuses. Depending on the bandwidth available, video, audio, text and graphics can be integrated with these technologies.

4. Conventional Educational Broadcasting

This is being used particularly in the four provinces which have dedicated educational television networks. In western Canada a number of universities have formed the Western University Telecourse Consortium as a means of pooling resources to develop and acquire appropriate telecourse material to be broadcast on the provincial educational networks.

5. Modem Access

Many institutions are using the existing telephone networks and accessing them through relatively slow-speed modems for the purpose of interacting with text and graphics. Typical problems encountered by institutions using these various technologies have to do with their accessibility for students; staff and faculty training in the appropriate use of the technologies; the cost of acquiring necessary equipment; the cost of line charges; and, most profoundly, the lack of available high-quality instructional materials.

Mexico

The driving force behind the use of technology in higher education in Mexico has been higher education institutions. They have played a key role in the conceptual development of distance education and the creation of educational technology for daily use in the classroom. Development, however, has been highly unequal among institutions. Until very recently policies and ideas for the use of technology in education were institution-specific. This fact is changing because of the influence of such highly successful experiences as that of ITESM, the largest private higher education system in Mexico.

Among the public universities which produce and broadcast educational programs and materials through television and information networks are the

Universidad Nacional Autónoma de México, Universidad Pedagógica Nacional, and the Instituto Politécnico Nacional.

Assimilation of new technologies by faculty and students varies in different institutions. Some institutions have specific programs to teach faculty the advantages and techniques of using technology in the classroom. This is important, for example, for developing such instructional materials as CD-ROMs, where faculty need to participate in the development of the content and the format. Students have few problems learning technology. The main challenge for them is the fact that education becomes more of an individual responsibility, rather than a group responsibility. Self-initiated learning and management of knowledge are key abilities to develop in students.

Most private and public universities have Internet access, but infrastructure, funding and policies vary in each institution. Interinstitutional collaboration would certainly give momentum to the use of technology in higher education in Mexico by encouraging the creation of a compatible and uniform infrastructure and sharing of experiences.

Perhaps one of the most successful and tangible examples of the use of technology in higher education in Mexico is the Virtual University of ITESM. This program was established in 1989. Initially, it was a means of extending the ability of the ITESM University System to train its faculty. The multicampus structure of ITESM, with 26 campuses in 25 cities around Mexico, created a unique challenge and opportunity for the development of such a system. Today, the Virtual University of ITESM transmits more than 240 hours per week of high school, undergraduate, graduate, and continuing education courses. In 1995, 25,890 students took one or more courses through the Virtual University. Students can interact with teachers by e-mail, touch-pad, phone and fax.

The Virtual University has internationalized its activities throughout the Americas. Its signal is received in several Central and South American countries, and it broadcasts programs from and to universities such as Waterloo in Canada and Carnegie-Mellon in the U.S.A.

United States

As faculty begin to experiment with various technologies in their teaching, students are asking for more services to be available electronically. Many campuses are trying to adjust their traditional policies to accommodate the increased use of computer networks by both on- and off-campus students. However, most institutions' policies support the traditional ways of working with students:

- Faculty are rewarded on the basis of the number of classes taught and their publications;
- A specific number of hours in a classroom is equated to standards of credit;
- Students are expected to be on campus to have access to such services as registration, advising, discussions with faculty and use of library materials.

A few universities are experimenting with new reward structures for faculty who invest time designing new technology-based learning environments which seem to result in greater engagement and consequently better performance by the students. These usually take the form of different employment tracks for faculty members that determine whether they will be rewarded based on the quality of their research or their teaching.

A new trend that has generated a lot of interest is requiring all on-campus students to have computers. This is being done at public liberal arts campuses with very heterogeneous student populations as well as more technically oriented private universities. Students either purchase laptops with the help of discounts and financial assistance, or leasing arrangements are made with the manufacturers. Campus networks allow students to use these new tools in all aspects of their classes and research. As demand increases for Internet access and support services, campus networks are being overwhelmed. As a result, there is a new trend toward developing relationships with third party providers of Internet access services. Students and faculty are then offered discounts from the service provider.

Another trend is the integration of several types of technologies within a single course to allow students greater learning and access options. Technology also enables or facilitates "short courses" of a day or a few weeks, which are becoming more common.

As U.S. colleges and universities gain more experience serving students electronically, they notice the students' preference for more asynchronous learning materials which can be used any time. This option seems popular with students both on and off campuses.

E. Collaboration Between Business and Higher Education

In all three countries, businesses and higher education institutions are recognizing the mutual benefits of collaboration in developing educational technologies. Both institutions and businesses are initiating such collaborations.

Canada

Network providers recognize that it is in their business interests to create access to their networks for educational institutions by ensuring that the necessary connections are in place. Both the telephone industry and the cable industry (which in Canada is very significant) have also established funds which can be accessed by educational institutions to assist with the development of courseware.

Mexico

Technology and information have become two extremely important factors influencing Mexico's economic development. Recent telecommunications advances include the rapid development of telephone companies, installation of new fiber optic networks, a good satellite infrastructure recently opened to private investment, and the availability of one of the largest and most technologically advanced television networks in the world.

Effective partnerships are needed between higher education institutions and corporations. One example is the Virtual University of ITESM's recent agreement with MVS Multivision, an important private network of restricted television which operates in the main Mexican cities. The agreement permits ITESM to offer extension courses and degree programs using MVS' direct to home (DTH) system. Other universities are negotiating similar agreements with corporations such as Teléfonos de México (TELMEX).

United States

Many businesses have formed relationships with local institutions for mutual benefits. One classic example is the relationship developed in the early 1980s between California State University-Chico and the Hewlett Packard Company (HP). HP helped CSU-Chico develop an electronic network using satellite that allowed the campus to deliver its computer science degree programs to HP employees in many states. CSU-Chico has since developed a variety of programs which it offers to many groups of students not affiliated with HP.

Another example is the National Technological University (NTU), a collaboration involving high technology industries and many colleges of engineering throughout the U.S. The NTU works with industry sites to develop learning centers that can support the students and receive the digital satellite signal which is sent from the NTU headquarters in Ft. Collins, Colorado. This signal carries the courses from the engineering faculty at campuses throughout

the country. The high-technology industry representatives work with NTU faculty to help shape future programs to meet the emerging needs of their workforce.

More recently, private companies are forming educational institutions that utilize telecommunicated learning. Jones International, a major cable television company, has formed the International University College, which is currently seeking regional accreditation. In partnership with community colleges, Jones has also created the International Community College, which will use a wide variety of technologies.

F. Summary of the Current Policy Climate in the Three Countries

It is useful to analyze policy as it relates to the use of technology in higher education in terms of the components listed below. The reader should note that although all three components are relevant in Canada, Mexico and the United States, the urgency and level of discussion pertaining to these areas varies from country to country.

Networks: the "pipelines" that are provided by telephone, cable, the broadcast and satellite industries which enable signals to move from one point to another.

Appliances: the devices that we connect to the networks in order to send and receive information. These are television sets, telephones, faxes, computers, etc.

Information content: what we send to one another using the appliances and via the networks. In education this is the instructional material in various media formats as well as real-time dialogue which may be text, audio, video, or combinations.

Using this model, the following observations can be made with regard to policy in the three countries.

1. Networks

Educators want access to bandwidth on demand and at rates that are affordable. The adoption of this policy by the federal regulator and the implementation by the network providers is essential to broad application of

technology throughout the higher education system. The need for such a policy approach is recognized but is not yet in place and therefore remains a major limiting factor.

The second important policy component is the need for physical access to the networks. For the most part the "pipelines" have been distributed to maximize return on the provider's investment. This has left regions with low population density with very poor or no access to networks.

2. Appliances

One problem being encountered is that institutions find it difficult to acquire the capital resources to purchase appliances and, once purchased, to maintain them given the rapidity of obsolescence. Funding policies for institutions are still largely based on the need to support teachers in classrooms.

The most critical aspect of public policy in this arena, at least in the case of Canada and the U.S., again relates to access. Some provinces and states, but not all, have recognized in their technology policies the need to create community-based "learning centers" to ensure that people have ready access to various appliances which they do not have either in their home or in their place of work. Failure to address this need through public policy is likely to have the effect of widening the access gap to education and training opportunities between the economically advantaged and disadvantaged.

3. Information Content

It is in this area that the most significant problems result. Because of institutional funding models, single institutions find it very difficult to accumulate the funds needed to develop high-quality instructional software. Furthermore, inter-institutional relationships in higher education, long characterized by independence and autonomy, make it difficult to accept each other's course materials. Hence, institutions miss opportunities to achieve economies of scale in terms of utilization. Policies in this area are urgently needed to foster partnerships and consortia-based approaches to dealing with these issues. The Western Governors University project in the U.S. is an example of a public policy shift in this direction.

III. Cross-Border Collaboration: Opportunities for Action

In developing policy for bilateral and trilateral collaboration, it should be recognized that the main factors influencing the utilization of technology in higher education are not concerned with technology itself. The questions about how to use technology and what technologies to use are relatively easy. What is infinitely more important, and more difficult to achieve, are changes in the way institutions of higher education function, and many changes are needed to take full advantage of the educational potential of technology.

As institutions begin offering more educational opportunities electronically, the potential for direct competition between the U.S., Canada and Mexico develops. Alternatively, cross-border collaboration may be more cost-effective and beneficial in many ways, including, for example, increasing cross-cultural understanding. To date, most cross-border agreements have been inter-institutional and bilateral. This paper is an initial attempt to explore the issues from a trilateral perspective. For effective partnerships to be built, the potential partners will need to learn a great deal from one another to be able to benefit from what each has to contribute.

Specifically, this trinational team suggests the following opportunities for trilateral actions, as a basis for discussion:

1. The development of trinational policies regarding accreditation of distance education courses and portability of students' knowledge and skills acquired among institutions and across borders.

2. Trinational staff and faculty training in the use of technology; for example, instructional design, uses of various appliances, and the provision of student support services.

3. Trinational discipline-specific forums where faculty with similar interests will be able to interact and develop collaborative projects.

4. The implementation of a few pilot programs which should be well documented, evaluated and publicized, so that many may learn from the expensive lessons of the few.

5. Creation of a mechanism for international and inter-institutional sharing of information and experience in the use of technology in higher education.

6. Creation of consortia and partnership models for the development of instructional materials suited to a world of digital multi-media.

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